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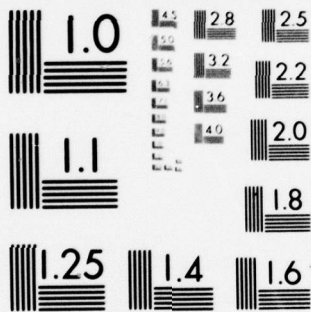
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HUDSON RIVER BASIN

HUDSON COUNTY

NEW JERSEY

LEVEL II

JERSEY CITY RESERVOIR NO.2 DAM

PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

⑥ National Dam Safety Program. Jersey
City Reservoir Number 2 Dam (NJ-00523),
Hudson River Basin, Hudson County,
New Jersey. Phase I Inspection Report.

⑮ DACW61-78-C-0124

DDC

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⑨ Final rept, NJ 00523

⑩ F. Keith / Jolls

⑪ Aug 78



⑫ 56p.

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE-2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, NJ 08621

26 SEP 1978

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Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Jersey City Reservoir No. 2 in Hudson County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given on the first three pages of the report.

Based on visual inspection, available records, calculations and past operational performance, Jersey City Reservoir No. 2 Dam, a high hazard potential structure, is judged to be in fair overall condition. It is a pumped storage reservoir fed by pipelines from Boonton Reservoir, and has no natural stream inflow. Since there is sufficient storage volume to contain the Probable Maximum Precipitation (PMP) event without overtopping, a spillway is not required. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Within one year from the date of approval of this report, engineering studies and analyses should be performed by a qualified professional consultant, engaged by the owner, to perform engineering investigations of the character of the embankment and foundation materials and stability analyses and piezometric studies of the structure to more clearly define the condition of the structure.

b. Within one year from the date of approval of this report, the following remedial actions should be taken.

- (1) Provide an alarm and warning system.
- (2) Clear the overflow pipe and restore it to operation.
- (3) Remove brush and sapplings from the earth portion of the walls and replant with suitable ground cover.

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JERSEY CITY RESERVOIR NO. 2 DAM (NJ00053)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 24 June 1978 by Louis Berger and Associates, Inc. under contract to the State of New Jersey. The state, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

The Jersey City Reservoir No. 2 Dam, a high hazard potential structure, is judged to be in fair overall condition. It is a pumped storage reservoir fed by pipelines from Boonton Reservoir, and has no natural stream inflow. Since there is sufficient storage volume to contain the Probable Maximum Precipitation (PMP) event without overtopping, a spillway is not required. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Within one year from the date of approval of this report, engineering studies and analyses should be performed by a qualified professional consultant, engaged by the owner, to perform engineering investigations of the character of the embankment and foundation materials, stability analyses and piezometric studies of the structure to more clearly define the condition of the structure.

b. Within one year from the date of approval of this report, the following remedial actions should be taken.

- (1) Provide an alarm and warning system.
- (2) Clear the overflow pipe and restore it to operation.
- (3) Remove brush and sapplings from the earth portion of the walls and replant with suitable ground cover.
- (4) Consider upgrading and automating the gate house control equipment.
- (5) Provide additional drawdown/discharge capability.
- (6) Establish a system of periodic dam safety inspections for this dam.

APPROVED: _____

JOEL T. CALLAHAN

Lieutenant Colonel, Corps of Engineers
Acting District Engineer

DATE: _____

26 September 1978

NAPEN-D

Honorable Brendan T. Byrne

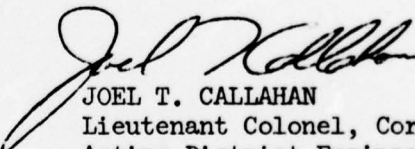
- (4) Consider upgrading and automating the gate house control equipment.
- (5) Provide additional drawdown/discharge capability.
- (6) Establish a system of periodic dam safety inspections for this dam.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Joseph LeForte of the Fourteenth District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely yours,



JOEL T. CALLAHAN
Lieutenant Colonel, Corps of Engineers
Acting District Engineer

1 Incl
As stated

Cy Furn:
Mr. Dirk C. Hofman
Department of Environmental Protection

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam Jersey City Reservoir No. 2 NJ 00523

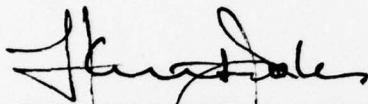
State Located New Jersey
County Located Hudson
Coordinates Lat.4044.4 - Long.7403.5
Stream None
Date of Inspection 24 June 1978

ASSESSMENT OF
GENERAL CONDITIONS

Jersey City Reservoir No. 2 appears to be in a stable and adequate condition. However, failure could cause significant property damage to surrounding residential areas and result in a major loss of life. Because no engineering data was available regarding the methods of construction or zoning of the embankment, it is ineffectual, in engineering terms, to express anything but a questionable opinion regarding the long-term adequacy of the perimeter structure. Therefore, further investigative studies are recommended to be undertaken in the near future.

Recommended remedial actions include: 1) an alarm system be installed 2) the overflow pipe be cleared and made operational 3) remove vegetation root systems and replant with suitable ground cover 4) upgrade and

automate control equipment 5) provide additional emergency drawdown/discharge capacity. There is sufficient storage volume in the reservoir to contain the PMP rainfall without overtopping.



F. Keith Jolls P.E.
Project Manager





OVERVIEW OF JERSEY CITY RESERVOIR #2
(CIRCA 1969)

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM JERSEY CITY RESERVOIR NO. 2 FED# NJ 00523

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with contract FPM-36 between Louis Berger & Associates, Inc. and the State of New Jersey and its Department of Environmental Protection, Division of Water Resources. The State, in turn, is under agreement with the U.S. Army Corps of Engineers, Philadelphia to have this inspection performed.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the Jersey City Reservoir No. 2 and appurtenant structures, and to determine if it constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Reservoir and Appurtenances

Jersey City Reservoir No. 2 is a man-made, elliptical shaped basin with earth embankments and is utilized by the City of Jersey City for water storage and supply purposes. Constructed in the late 19th century, the reservoir is about 2760 feet in circumference with the embankment ranging from about five to twenty feet above the surrounding streets. The interior slopes are overlain with unmortared riprap. The crest berm is about twenty feet wide at the top and covered with vegetation along the outer toe. A short portion in front of the gate house has a cobblestone pavement (see photograph in Appendix).

The influent gate house is on the northeast side of the reservoir. The influent piping consists of a 16" main with a manually operated butterfly valve. The 16" pipe discharges into a distribution chamber which, in turn, discharges into the reservoir over a concrete block spillway whose crest is at elevation 127 MSL. The gate house contains two turbine pumps, one of which is inoperative and the second of which leaks quite excessively.

A screen house and five effluent pipes are located in the southeast portion of the reservoir. A large diameter overflow pipe (36") is located near the screen house at invert elevation 126+. The reservoir is surrounded by a chain link fence which is broken in several locations. A chlorination house is located adjacent to and outside the reservoir embankment. For layout, see Figure 2.

b. Location

Jersey City Reservoir No. 2 is located in the City of Jersey City, Hudson County. It is bounded on the west by Collard Street, on the east by Summit Avenue, on the north by Troy and Lake Streets, and on the south by Laidlaw Avenue. Reservoir No. 3 is immediately to the east on the other side of Summit Avenue.

c. Size Classification

The reservoir is a man-made pool whose walls range in height from 5' to 20' above the surrounding streets. The hydraulic head at the designed normal pool elevation ranges from 1' to 16'. Storage at the max. pool elevation is 215 acre-feet. Based on the foregoing, the reservoir is in the small size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

Jersey City Reservoir No. 2 is located in a residential area of the city known as the "Heights". It is surrounded by apartment buildings, private residences, small businesses, and a community park and swimming pool. To the immediate south and downslope is a depressed highway, a depressed railroad, a railroad tunnel, a public school, a fire station, a hospital and several major traffic arteries. Failure of the containing structure could cause extensive property damage and a major loss of life. Accordingly, Jersey City Reservoir No. 2 is classified as high hazard (as is Reservoir No. 3).

e. Ownership

The reservoir is owned by the City of Jersey City, City Hall, 280 Grove Street, Jersey City, New Jersey, 07302.

f. Purpose of Dam

The reservoir is utilized as an in-city water supply which, owing to the elevation of its location, provides most of Jersey City with potable water by gravity flow.

g. Design and Construction History

This Jersey City reservoir was apparently designed by personnel of the Jersey City Board of Public Works in the late 1800's. Details of the initial construction are unknown although a history of continuing upgrading of appurtenances since the original design period has been reported by the city.

h. Normal Operating Procedures

City personnel are on duty at Reservoir No. 2 on a 24 hour/day schedule. Apart from grounds keeping, major duties of the personnel consist of monitoring and control of water levels in the reservoir.

Water level in the reservoir is normally adjusted only once a day. Water level in the reservoir is allowed to be drawdown slightly during the daylight hours. In the evening the inflow is increased and the reservoir is allowed to refill to the 127.0 operating elevation by gravity flow from the Boonton Reservoir. Every morning the day shift readjusts the influent valves.

The turbine pump in the gate house is utilized to supply water to a small section of the city to the north of, and at a higher elevation than the reservoir.

1.3 PERTINENT DATA

a. Drainage Area

Not applicable. All inflow to the reservoir is via transmission lines from Boonton Reservoir. Catchment area = 13.3 acres.

b. Discharge from Reservoir

Maximum discharge capacity of the effluent pipes is 10+ cfs (limited by consumption rate).

c. Elevation (Ft. above MSL)

| | | |
|------------------------|---|---------------|
| Top of reservoir walls | - | 131.0+ |
| Normal design pool | - | 127.0 |
| Operating pool | - | 127.0 |
| Influent piping invert | - | Unknown |
| Effluent piping invert | - | 106+ |
| Reservoir bottom | - | 105+ to 114 + |
| Surrounding streets | - | 110+ to 126+ |

d. Reservoir

Length of maximum pool - 950 feet
Elliptical circumference - 2760 feet

e. Storage

| | | |
|--------------------|---|---------------|
| Normal design pool | - | 163 acre-feet |
| Top of reservoir | - | 215 acre-feet |

f. Reservoir Surface

Top of reservoir - 13.3 acres
Normal design pool - 12.9 acres

g. Reservoir Walls

Type - Earth embankment; riprapped interior slope.

Perimeter - 2760 feet

Height - 5' to 20' (above street grade)

Top Width - 20 feet+

Side Slopes - Outer slope is 2 to 1; interior slope above waterline is 1.5 to 1.

Impervious Core - Unknown

Zone - Unknown

h. Diversion and Regulating Tunnel

None

i. Spillway

None

j. Regulating Outlets (All pipe sizes are approx. diameter)

One 20", two 26" and two 36" effluent pipes at approximate invert 106. One 36" overflow pipe at approximate invert 126.

k. Regulated Inlets

One 16 inch influent pipe, invert unknown. Eight foot wide distribution chamber spillway into reservoir at crest elevation 127.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The information available for review of Jersey City Reservoir No. 2 included:

- 1) Several ~~engine~~engineering drawings depicting piping, reservoir layout and buildings.
- 2) U.S.G.S. Quadrangle - Jersey City, New Jersey scale 1:24000.

2.2 CONSTRUCTION

Information pertaining to the construction or history of this reservoir was not available with the exception of oral communication with city personnel describing only relatively recent modifications to appurtenances.

2.3 OPERATION

No written operational procedures were available for the review but communication with city personnel reveals the reservoir is allowed to drawdown during the daylight hours. In the evening the influent line is opened and the reservoir is refilled to the design elevation of 127 overnight.

The old turbine pump which pushes water up to the "Heights" section of the city is merely used to defray pumping costs since it is powered by water pressure from the incoming transmission line from Boonton. The turbine pumps could, if necessary, be taken out of operation at any time with no loss of service to the upper sections of the city.

The discharge pipes always remain in an open position although operational valves are available on the reservoir grounds and in Summit Avenue outside the reservoir to shut down the effluent pipe if necessary.

2.4 EVALUATION

a. Availability

The only information available for the evaluations came from drawings of the reservoir and piping layout and verbal communication with city personnel. No information was available with respect to the structural design criteria, specifications, or stability analysis for the reservoir walls.

City personnel indicate that new piping will be installed at the north end of the reservoir sometime in the future. Inspection of the original design and construction methods and material will be possible at that time since the wall will be opened down to bedrock in order to accomplish the proposed modifications.

b. Adequacy

The design and construction of the reservoir has withstood the test of time and field inspections revealed no signs of failure or problem areas. However, the design and construction methods are completely unknown and stability analysis is, of course, impossible. The data available for evaluation of the stability of the reservoir embankment is therefore considered completely inadequate.

c. Validity

Because no engineering data was available, no comment can be made on validity.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

On-site inspections of the reservoir took place on June 24, 30 and August 17, 1978.

b. Embankment

The embankment of Reservoir No. 2 appears to be in fair condition. However, there is considerable vegetation on the outer slope of the embankment around the entire southern half of the reservoir. Some erosion was noted on foot paths leading down the outer face of the embankment and the top of the embankment was badly rutted from vehicles being driven around the reservoir on top of the earth berm. The cobblestone paving in front of the gate house is in good condition. The placed riprap facing on the interior slope of the reservoir appears to be in satisfactory condition. However, water elevation at the time of the inspections was near the top of the riprap course and the majority of the interior facing was hidden from view. The material which was visible appeared well aligned and no appreciable movement or settlement was observed. Vegetation extended down the inner slope of the reservoir from the top of the wall to the top of the riprap course. Some lake weed was noted growing through the riprap in the shallow water around the reservoir's edge.

c. Appurtenant Structures

There are two major structures located on the perimeter rim of the reservoir. These consist of the existing control (or gate) house containing one 16" influent pipe and

mechanically operated gate on the north-east corner of the basin and the screen house including the effluent pipes at the southeast corner of the reservoir. The present influent and effluent structures as well as their controls and appurtenances are quite old. There are two turbine pumps in the control house. One is completely inoperative and the second, which is functional to some degree, leaks quite excessively. The pump, which is driven by incoming water pressure from the Boonton transmission lines, is utilized as an auxiliary pump to move water further up into the "Heights" section of Jersey City. The leak in the packing of this pump has existed for several years and increases as time passes. At present the pump is surrounded by sand bags and plywood sheathing to contain the spraying water and direct it back into the pump well.

Although this pump is in poor condition it is apparently redundant to the water distribution system. The only reason this pump is still utilized is to take advantage of the pressure in the incoming transmission lines and to reduce the pumping operating costs.

d. Reservoir Area

The general condition of the reservoir area appears satisfactory. No signs of excessive deterioration to the embankment walls were noted despite their advanced age. Vandalism is kept to a minimum due to fencing and personnel on duty in the control house around the clock.

During each of the inspections, the water level in the reservoir was observed at the design elevation. No major seepage or leaks were noted emanating from the reservoir.

e. Railroad Tunnel

The main tunnel of the Erie-Lackawanna Railroad passes about 70 feet below and 50 feet to the south of the reservoir (for location of the tunnel, see Figure 2). Some slight seepage flow into the tunnel has occurred continuously for at least the past 35 years. Despite routine maintenance and some special grouting work, a flow rate of 10 gallons per minute has not noticeably increased or decreased in recent years. At the time of the inspection, the tunnel seepage is greater in the vicinity of the reservoir, but was not limited to the area. It is not possible to attribute the tunnel seepage to reservoir leakage on the basis of the inspection. However, it is entirely possible that water from the reservoir is passing into the ground water regime via surface fractures in the underlying bedrock.

3.2 EVALUATION

The primary concern of the inspection team was the structural integrity of the reservoir walls and the hydraulic controls which regulate the water elevation and consequently, the pressures to which the walls are subjected. Except for minor erosion and the rather heavy vegetation, there were no visible indications to impugn the integrity of the reservoir itself. The influent and effluent systems are safeguarded against failure with numerous backup valves in the street distribution system. While the operating turbine is in critical need of repair, its complete failure would not threaten the stability of the reservoir. However the sand bags, plywood and other equipment presently placed around the pump during its operation do seem to pose somewhat of a hazard to the operator.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are city personnel on duty at the reservoir 24 hours a day. Routine operations consist primarily of regulating the water level in the reservoir, monitoring flows and pressures in the piping system and operating the turbine pump.

The normal pool was designed and is usually maintained at elevation 127.0 although some drawdown occurs during daily operations. The valve to the 16 inch intake pipe is opened in the evening and the reservoir is allowed to fill overnight. The inflow is decreased in the morning and usually remains so all day. Water use and piping pressures are monitored and recorded. At the present time all operations in the gate house are conducted manually.

4.2 MAINTENANCE OF RESERVOIR

There does not seem to be any posted procedures for inspection or maintenance of the reservoir.

4.3 MAINTENANCE OF OPERATING FACILITIES

Design plans are in preparation to provide new pumping facilities to the piping system and eventually the valves, regulating devices, water level recordings, and monitoring equipment in the gate house will be automated. The turbine pumps, which have needed repairs for years, will be taken out of service when the new work is completed.

4.4 DESCRIPTION OF WARNING SYSTEM

There is no warning system in existence at Jersey City Reservoir No. 2 which would alert the operators to malfunction or failures in the system or to warn residents in the surrounding area of the possibility of an impending disaster.

Should complete failure of the reservoir and an accompanying flood appear imminent, the only means available to warn and evacuate nearby residents would be the public communications media (radio and television) or possibly the use of roving police patrol cars mounted with public address systems.

A subsurface failure could go unnoticed for a long period of time, depending on its extent, since only a visual observation of a decreasing water elevation in the reservoir would alert the operators to the potential hazard.

There does not appear to be a standard or periodic inspection procedure for the reservoir or the appurtenant facilities.

4.5 EVALUATION

The present procedures employed at this water storage facility appear adequate for day-to-day operations despite the somewhat obsolete nature of the equipment. However, the lack of periodic and specific inspection procedures, the complete absence of an internal hazardous-condition monitoring system as well as an early-warning public alert system are significant deficiencies with respect to safety procedures.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

Water enters Jersey City Reservoir No. 2 either as rainfall over the 13.3 acre catchment area or by the 16 inch influent pipe which is fed by the large diameter gravity transmission lines from the Boonton Reservoir. Since the influent piping is regulated, only rainfall was evaluated with respect to the hydraulic adequacy of the reservoir.

Although the size of reservoir is classified as small, the hazard potential is high. A precipitation event equivalent to a PMF was therefore selected to evaluate the hydraulic capacity in accordance with the guidelines of the Recommended Guidelines for the Safety Inspection of Dams.

Hydrometeorological Report No. 33 was employed to obtain the PMP for this region (which is 26 inches of rainfall in a 6 hour period). This is equivalent to 1,255,000 cubic feet in the catchment area. Since the reservoir is maintained at elevation 127 or lower, there is always a minimum freeboard of 4 feet with corresponding storage volume of 2,265,000 cubic feet available. Thus, the reservoir can accommodate almost twice the PMP without discharge. Water level in the reservoir during the PMP event would rise slightly more than 2 feet.

b. Experience Data

No history of excessive flows or dangerously high water levels have been reported at this site. Water level is routinely maintained at or slightly below the design elevation of 127 MSL.

c. Visual Observations

Water level in the reservoir at the time of the inspection was approximately elevation 126 and was entering the reservoir over the inlet spillway from the distribution chamber. No abnormalities were noted at this location. However, inspection of the turbine pumps in the gate house revealed that one is inoperative the other leaking very badly. Operation of the control mechanism for the influent pipe was observed during the inspection and appears to function adequately.

d. Overtopping Potential

With all facilities operating as designed, the potential for overtopping is almost non-existent. Personnel are on duty at the gate house 24 hours per day and continuously check the water level. If the level rises above normal, the flow into the reservoir from the transmission lines is decreased or shut down entirely either at the gate house or by numerous check valves on the lines outside the reservoir facility. As indicated above, the reservoir is capable of containing almost two times the amount of rainfall entering the reservoir from a 6 hour PMP event.

e. Drawdown

The discharge pipes are the only means to drawdown the reservoir and their capacity is limited by consumption rates within the distribution system. Since the average daily consumption from this reservoir is about 7,000,000 gallons (or 21.5 acre-feet) it is estimated it would take about 9 days to lower the water level in the reservoir from elevation 131 to 114, (the approximate street elevation to the south) and about 7 days to decrease the water level from elevation 127 to elevation 114. Based on the above, additional drawdown capabilities appear to be warranted in light of the high hazard classification.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

No major evidence was observed to indicate the existence of a serious instability problem.

b. Design and Construction Data

Design calculations and the original stability analyses were not available for this reservoir. Based on field observations and information obtained from various sources, the reservoir is founded on the underlying diabase bedrock formation. No information is available as to the base of the embankment although it is believed the embankment rests directly on bedrock at elevation 114 in the northern portion of the reservoir and the bottom of the reservoir basin is apparently unlined. Since the surface of the bedrock contains numerous cooling fractures and joints it is possible that considerable quantities of water may pass into the underlying bedrock. The underlying bedrock is very hard diabase of the Palisades formation and its durability is not affected by the passage of water.

c. Operating Records

No records or logs are maintained at this reservoir for operations other than water consumption, transmission line pressure, and water elevations.

d. Post Construction Changes

No major changes or additions have been made to the confining structure since its original construction. However, numerous modifications to some of the appurtenant facilities have been reported by city personnel. These changes include new screens, pump and piping

modifications, etc. and could have affected the structural condition, especially where the embankment would completely breach the transverse axis.

e. Seismic Stability

The reservoir has wide, low-relief walls which are founded on diabase bedrock. The reservoir is in seismic Zone 1 and it may be safely assumed the seismic forces would have only negligible effect on the structural stability. However, it should be noted that an inactive fault has been mapped immediately to the east of the reservoir. Additional evaluation of this zone may be warranted in light of recent minor seismic activity along the Ramapo Fault 25 miles to the west (less than 3 on the Richter scale).

SECTION 7 - ASSESSMENTS/RECOMMENDATIONS/REMEDIAL MEASURES

7.1 RESERVOIR ASSESSMENT

a. Safety

Jersey City Reservoir No. 2, which has stood for about 100 years, appears to be sound and adequate and exhibits only a few signs of its advanced age. However, because absolutely nothing is known regarding the engineered design and make-up of the embankment, its structural safety remains questionable. The reservoir is capable of completely containing a PMP event with a rise in the water level of only two feet above normal design pool. However no structural assessment can be made with respect to the stability of the embankments with any added load imposed upon them. Therefore, the present long-term condition remains questionable when inspected within the visual limitations inherent in the procedures stipulated by the Corps of Engineers.

Operational safeguards exist in the form of backup valve systems which assure standby control of the influent and effluent systems. However, the absence of an independent method of dewatering the reservoir and the lack of a functional overflow system are considerations which would provide additional safeguards against potential hazardous conditions.

b. Adequacy of Information

While the information available to evaluate the hydraulic and hydrologic capabilities of the reservoir was adequate, insufficient design and construction data was available to perform a definitive evaluation of the structural stability of the walls and their foundations.

c. Urgency

It is recommended that the remedial measures and additional evaluations described should be undertaken in the near future.

d. Necessity for Further Studies

Because the structural stability cannot be established with reasonable reliance based on available data, further investigations into the condition of the earth embankments, their foundations and manner of construction should be undertaken to provide a basis for cogent stability analyses. This should include test borings, test pits, piezometric readings and geotechnic analyses. A study and evaluation of alarm or warning systems should be undertaken to determine their applicability with respect to the alert requirements of the surrounding community as well as the need for an internal early warning system within the City Water Engineering Division.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

a. Recommendations

There are several courses of action which should be taken to improve the safety of Jersey City Reservoir No. 2. As previously stated, further investigation and evaluation of the construction of the earth containment is deemed necessary.

It is further recommended that the City of Jersey City evaluate its requirements for an internal alarm system to alert operators of any type of impending failure. The system may take the form of an automatic water level recorder with an alarm to indicate rapid changes in water elevation. In conjunction with an operator's alarm there should be community warning systems to alert residents in the surrounding area of potentially

hazardous conditions. This may take the form of public address system in conjunction with sirens or roving patrol cars. All systems should be tested at regular intervals and a program should be undertaken to educate nearby residents as to its existence.

It is recommended that the existing overflow pipe be tested and utilized in the future to assist in controlling water elevations.

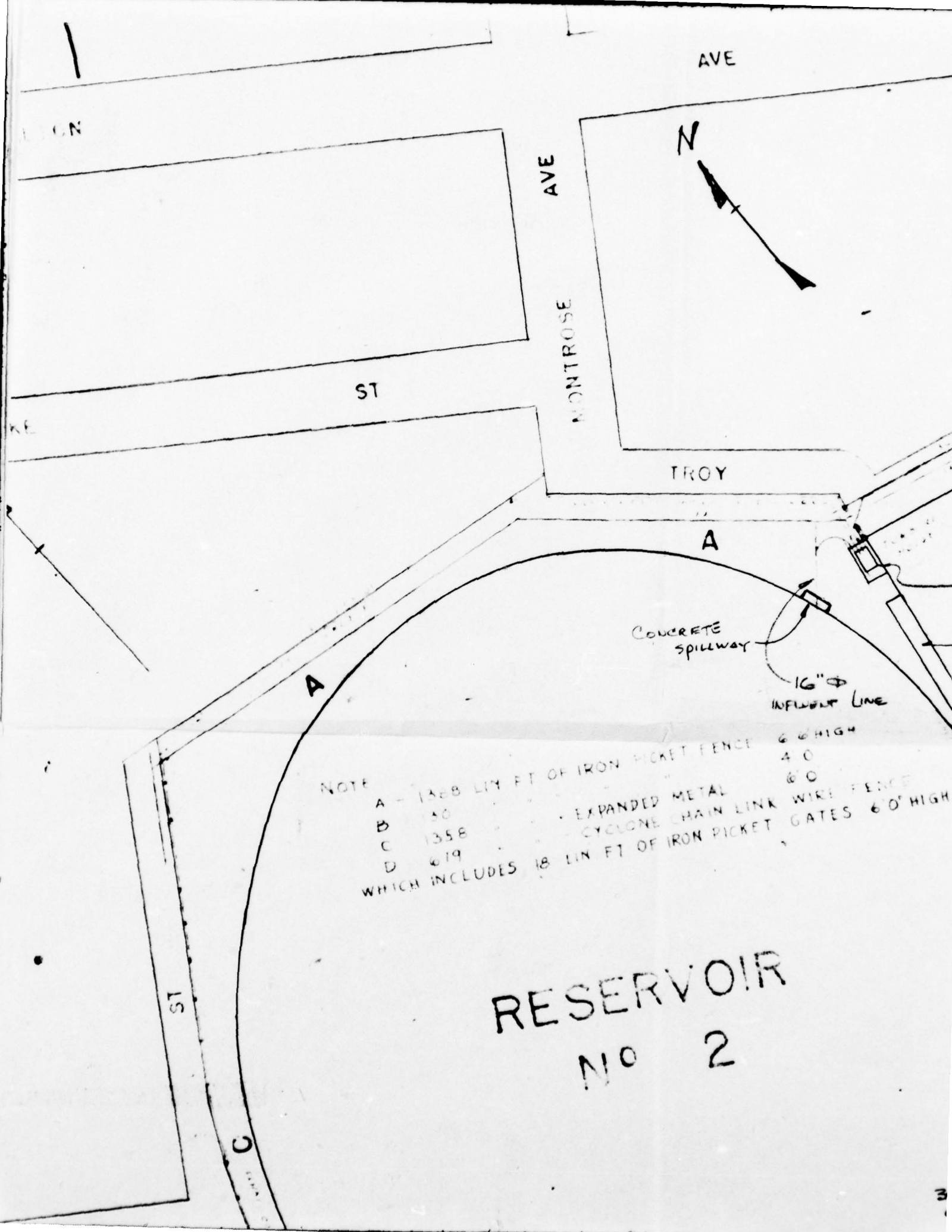
It is recommended that the brush and saplings on the earth slopes of the walls be removed to prevent root damage to the masonry. Suitable ground cover should be planted in selected areas and properly maintained.

It is suggested that the owner take under advisement the upgrading and automating the gate house regulatory and recording equipment sometime in the future. It is further suggested that the turbine pumps be repaired or removed from service since they constitute a hazard to personnel.

b. O&M Maintenance and Procedures

Although present procedures are being diligently pursued in a competent, workmanlike manner, it is suggested that city personnel employed at the reservoir receive additional training in the safety inspection of dams and reservoirs. It is further recommended that after training, these personnel conduct frequent, regularly schedule inspections as well as operational checks of the alarm systems.





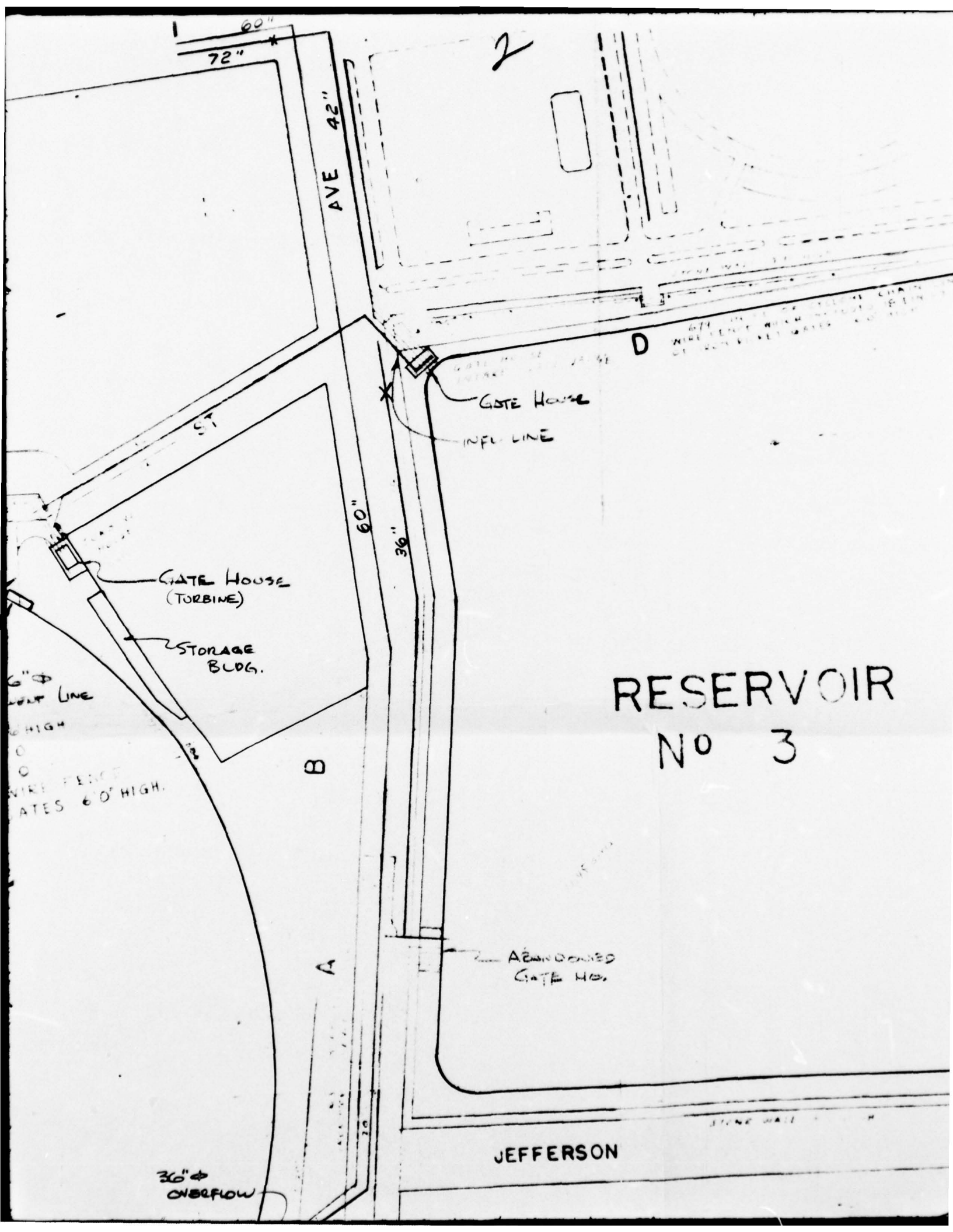
NOTE

| | | |
|-----|----------------------------------|------------|
| A - | 1328 LIN FT OF IRON PICKET FENCE | 6' 0" HIGH |
| B - | 130 | 4' 0" |
| C - | 1358 | 6' 0" |
| D - | 619 | |

WHICH INCLUDES 18 LIN FT OF IRON PICKET GATES 6' 0" HIGH.

EXPANDED METAL CYCLONE CHAIN LINK WIRE FENCE

RESERVOIR No 2



RESERVOIR
No 3

JEFFERSON

2

3



DATE MAY 12 1942
STAKE 12 12 42
D
NOTE: IN PLACE OF TELEPHONE CHAIN LINE
WIRE FENCE WITH WOODEN POSTS
OF 2" X 4" SET WATER 40' HIGH

GATE HOUSE
INFL. LINE

RESERVOIR No 3

ABANDONED
GATE HOS.

SCREEN 110
GATE HOS.
EFL. LINE

RESERVOIR
AVE

AVE

PROSPECT
ST

CENTRAL

WAVERLY
ST

JEFFERSON

ST

CONCRETE
SPILLWAY

NOTE
A - 1268 LIN FT OF IRON PICKET FENCE
B - 140
C - 1358
D - 619
WHICH INCLUDES 18 LIN FT OF IRON PICKET FENCE
EXPANDED METAL
CYCLONE CHAIN LINK

RESERVOIR

NO 2

1330000

T

ST

ST

C

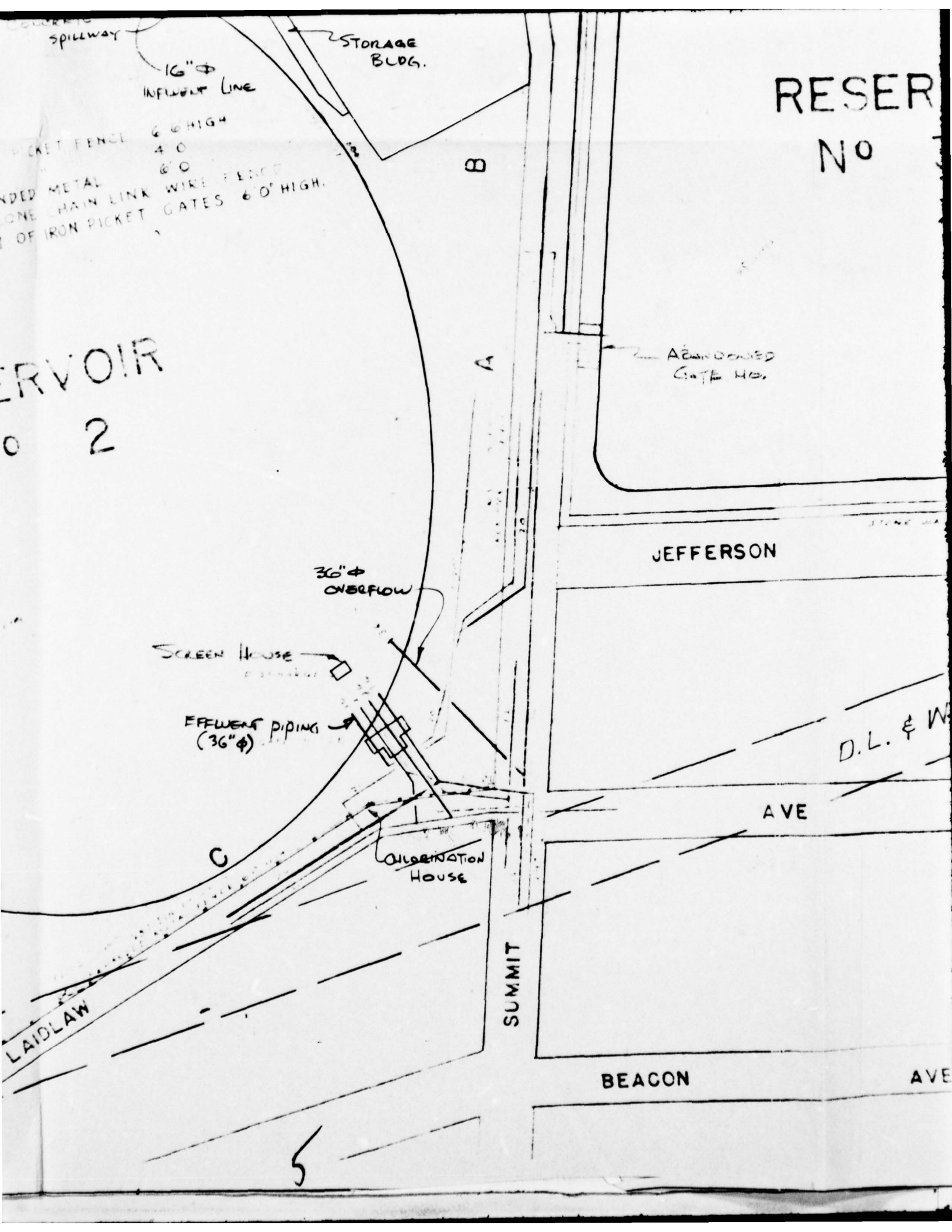
COLLARD

LAIDLAW

ST

HUDSON

M



RESERVOIR No 3

Abandoned
Gate No.

SCREEN 110

EFFL. LINE

CENTRAL

WAVERLY
ST

JEFFERSON

ST

D.L. & W.R.R. TUNNEL

AVE

DEPARTMENT OF PUBLIC WORKS - JERSEY CITY, N. J.

BUREAU OF WATER

PLAN SHOWING J.C. PROPERTY
AT HIGH SERVICE AND PRESENT
PROTECTIVE FENCE.

SCALE: 1"=100'

MAY 15, 1934

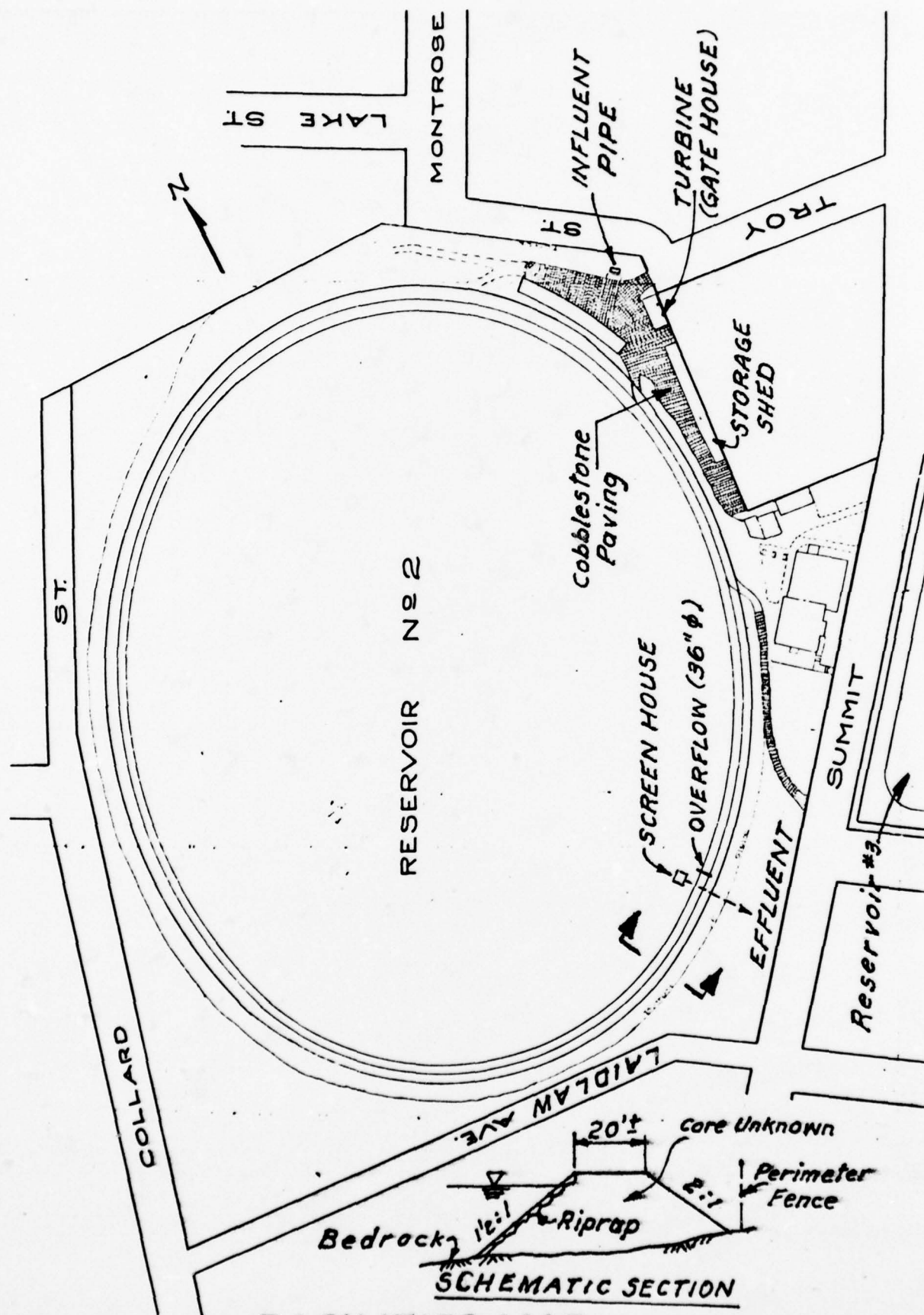
Figure 2

ON

AVE

DIRECTOR

12-B-23



FACILITIES MAP

Figure 3

SHEET 1

Check List
Visual Inspection
Phase 1

Name Dam Jersey City Res. #2 County Hudson State New Jersey Coordinators NJDEP

Date(s) Inspection 8/24, 6/30/78 Weather Sunny Temperature 95 F

Pool Elevation at Time of Inspection 127 M.S.L. Tailwater at Time of Inspection N/A M.S.L.

Inspection Personnel:

T. Chapter R. Lang
M. Carter D. Mulligan
K. Jolls

K. Jolls Recorder

CONCRETE/MASONRY DAMS

SHEET 2

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|--|---------------|---|
| SEEPAGE OR LEAKAGE | None observed | |
| STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS | N/A | |
| DRAINS | N/A | |
| WATER PASSAGES | N/A | Only concrete structure in embankment is inlet spillway at Gate House. |
| FOUNDATION | N/A | Founded on bedrock (according to City engineers). |

CONCRETE/MASONRY DAMS

SHEET 3

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|--------------------------------------|--------------|----------------------------|
| SURFACE CRACKS CONCRETE SURFACES | N/A | |
| STRUCTURAL CRACKING | N/A | |
| VERTICAL AND HORIZONTAL ALIGNMENT | N/A | |
| MONOLITH JOINTS | N/A | |
| CONSTRUCTION JOINTS | N/A | |

EMBANKMENT

SHEET 4

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|--|---|--|
| SURFACE CRACKS | None visible | |
| UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE | None | |
| SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES | Some erosion on south end of reservoir primarily at footpaths | |
| VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST | OK | Crest rutted from vehicular traffic. Short cobblestone pavement in area in front of Storage bldg. |
| RIPRAP FAILURES | None observed | |

EMBANKMENT

SHEET 5

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|---|---|--|
| E.L.R.R. RAILROAD TUNNEL | Approximately 70 feet under south end of reservoir. Seepage observed along entire tunnel. | Tunnel-heavy operations. Seepage heavier in vicinity of reservoir. |
| JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM | N/A | |
| ANY NOTICEABLE SEEPAGE | None Observed (perimeter embankment structure) | |
| STAFF GAGE AND RECORDER | Water level gage Transmission line pressure gage (in gage house) | Located directly in front of concrete block spillway. |
| DRAINS | 36" overflow drain at approx. elevation 126. | Line is plugged (or valve is closed) |

OUTLET WORKS

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|--|---|---|
| CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT | N/A | |
| INTAKE STRUCTURE | See comment on page 2 for intake spillway. | |
| OUTLET STRUCTURE | 36" discharge pipe at approx. invert Elevation 106 not observed. Turbine pumps (2) in gate house. | 1 pump inoperative; other leaking badly. |
| OUTLET CHANNEL | Not observed | |
| EMERGENCY GATE | None | |

UNGATED SPILLWAY

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|-----------------------|--------------|----------------------------|
| CONCRETE WEIR | N/A | |
| APPROACH CHANNEL | N/A | |
| DISCHARGE CHANNEL | N/A | |
| BRIDGE AND PIERS | N/A | |
| | | |

GATED SPILLWAY

| GATED SPILLWAY | | REMARKS OR RECOMMENDATIONS |
|-------------------------------|--------------|----------------------------|
| VISUAL EXAMINATION OF | OBSERVATIONS | |
| CONCRETE SILL | N/A | |
| APPROACH CHANNEL | N/A | |
| DISCHARGE CHANNEL | N/A | |
| BRIDGE AND PIERS | N/A | |
| GATES AND OPERATION EQUIPMENT | N/A | |

INSTRUMENTATION

| INSTRUMENTATION | | REMARKS OR RECOMMENDATIONS |
|---|--------------------------|----------------------------|
| VISUAL EXAMINATION MONUMENTATION/SURVEYS | OBSERVATIONS | |
| | None observed | |
| OBSERVATION WELLS | None | |
| WEIRS | None | |
| PIEZOMETERS | None | |
| OTHER | Water line pressure gage | Located in gate house. |

RESERVOIR

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|-----------------------|---|----------------------------|
| SLOPES | Rip-rap on interior slopes. Heavy growth of brush and weeds on top of walls and exterior slopes. | Remove growth |
| SEDIMENTATION | None apparent. | |
| | | |
| | | |
| | | |

DOWNSTREAM CHANNEL

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|---|--|----------------------------|
| CONDITION (OBSTRUCTIONS, DEBRIS, ETC.) | Urban Development | |
| SLOPES | N/A | |
| APPROXIMATE NO. OF HOMES AND POPULATION | Very dense urban development with population of 10's of thousands per square mile. | |
| | | |
| | | |

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
Jersey City Reservoir No. 2

| ITEM | REMARKS |
|----------------------------|--------------------------------|
| PLAN OF DAM | Available (1"=100' plan) |
| REGIONAL VICINITY MAP | Available (USGS Quad Sheet) |
| CONSTRUCTION HISTORY | Not Avail. |
| TYPICAL SECTIONS OF DAM | Not Avail. |
| HYDROLOGIC/HYDRAULIC DATA | N/A |
| OUTLETS - PLAN | Not Avail. |
| - DETAILS | " " |
| -CONSTRAINTS | " " |
| -DISCHARGE RATINGS | " " |
| RAINFALL/RESERVOIR RECORDS | " " |

| ITEM | REMARKS |
|----------------------------------|-------------|
| DESIGN REPORTS | None Avail. |
| GEOLOGY REPORTS | None Avail. |
| DESIGN COMPUTATIONS | None Avail. |
| HYDROLOGY & HYDRAULICS | " " |
| DAM STABILITY | None Avail. |
| SEEPAGE STUDIES | None Avail. |
| MATERIALS INVESTIGATIONS | None Avail. |
| BORING RECORDS | " " |
| LABORATORY | " " |
| FIELD | " " |
| POST-CONSTRUCTION SURVEYS OF DAM | None Avail. |
| BORROW SOURCES. | Not Avail. |

| ITEM | REMARKS |
|---|------------------------------|
| MONITORING SYSTEMS | Water level stage recorder , |
| MODIFICATIONS | Unknown |
| HIGH POOL RECORDS | None Available |
| POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS | None Available |
| PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS | None |
| MAINTENANCE OPERATION RECORDS | None Available |

| ITEM | REMARKS |
|------|---------|
|------|---------|

SPILLWAY PLAN

SECTIONS

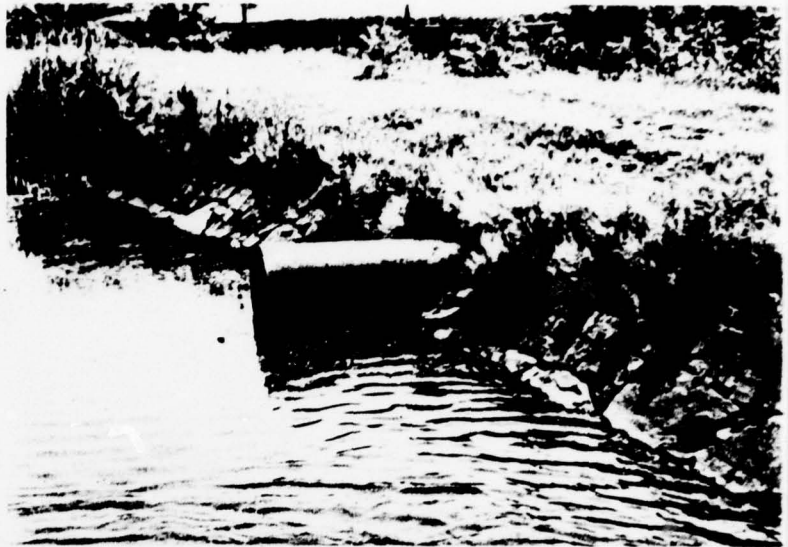
DETAILS

N/A

OPERATING EQUIPMENT
PLANS & DETAILS

None Avail.

36" Ø OVERFLOW
AT SE CORNER



SCREEN HOUSE - SE

TOP OF EMBANKMENT
(INDICATING COBBLESTONE
PAVING AT STORAGE SHED
& GATE HOUSE)



CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Not Applicable

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 127 MSL (163 Acre-Feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 131 (215 Acre-Feet)

ELEVATION MAXIMUM DESIGN POOL: 127 MSL

ELEVATION TOP DAM: 131 MSL

CREST: Entire circumference of wall (same elevation)

- a. Elevation 131 MSL
- b. Type Earth Embankment
- c. Width Approximately 20 feet at top
- d. Length 2760 feet in circumference
- e. Location Spillover Overflow pipe in southeast corner
- f. Number and Type of Gates None

OUTLET WORKS: _____

- a. Type 36" Discharge Pipe
- b. Location Southeast side of reservoir
- c. Entrance inverts About 106 MSL
- d. Exit inverts Unknown
- e. Emergency draindown facilities Same

HYDROMETEOROLOGICAL GAGES: _____

- a. Type Graduated Precipitation
- b. Location Near gate house
- c. Records Daily readings

MAXIMUM NON-DAMAGING DISCHARGE: 150 cfs (calculated capacity)*

*Actual capacity governed by consumption rate in City Water Supply System.

BY DJM DATE 2-78

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A1

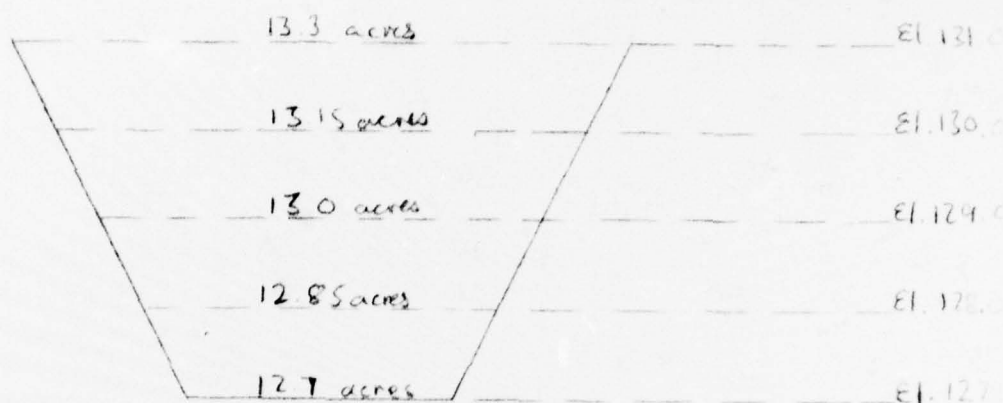
CHKD. BY _____ DATE _____

JERSEY CITY Reservoir # 2

PROJECT C222

SUBJECT _____

Storage Capacity



$$\text{Storage @ El. 127} = 163 \text{ acre feet}$$

$$\begin{aligned} \text{Storage @ El. 128} &= \frac{(12.85 + 12.7) \times 1}{2} + 163 \\ &= 175.78 \text{ acre feet} \end{aligned}$$

$$\begin{aligned} \text{Storage @ El. 129} &= \frac{(13 + 12.7) \times 2}{2} + 163 \\ &= 188.7 \text{ acre feet} \end{aligned}$$

$$\begin{aligned} \text{Storage @ El. 130} &= \frac{(13.15 + 12.7) \times 3}{2} + 163 \\ &= 201.78 \text{ acre feet} \end{aligned}$$

$$\begin{aligned} \text{Storage @ El. 131} &= \frac{(13.3 + 12.7) \times 4}{2} + 163 \\ &= 215 \text{ acre feet} \end{aligned}$$

Reservoir was assumed to be circular for the purpose of our calculations.

BY TC DATE 8-78 LOUIS BERGER & ASSOCIATES INC. SHEET NO. A2 OF
CHKD. BY DATE JERSEY CITY RESERVOIR No. 3 PROJECT C-222
SUBJECT PROBABLE MAXIMUM PRECIPITATION

FROM: Hydromet. Report No. 33

6 Hour PMP = 26 inches

Catchment Area = 13.3 Acres

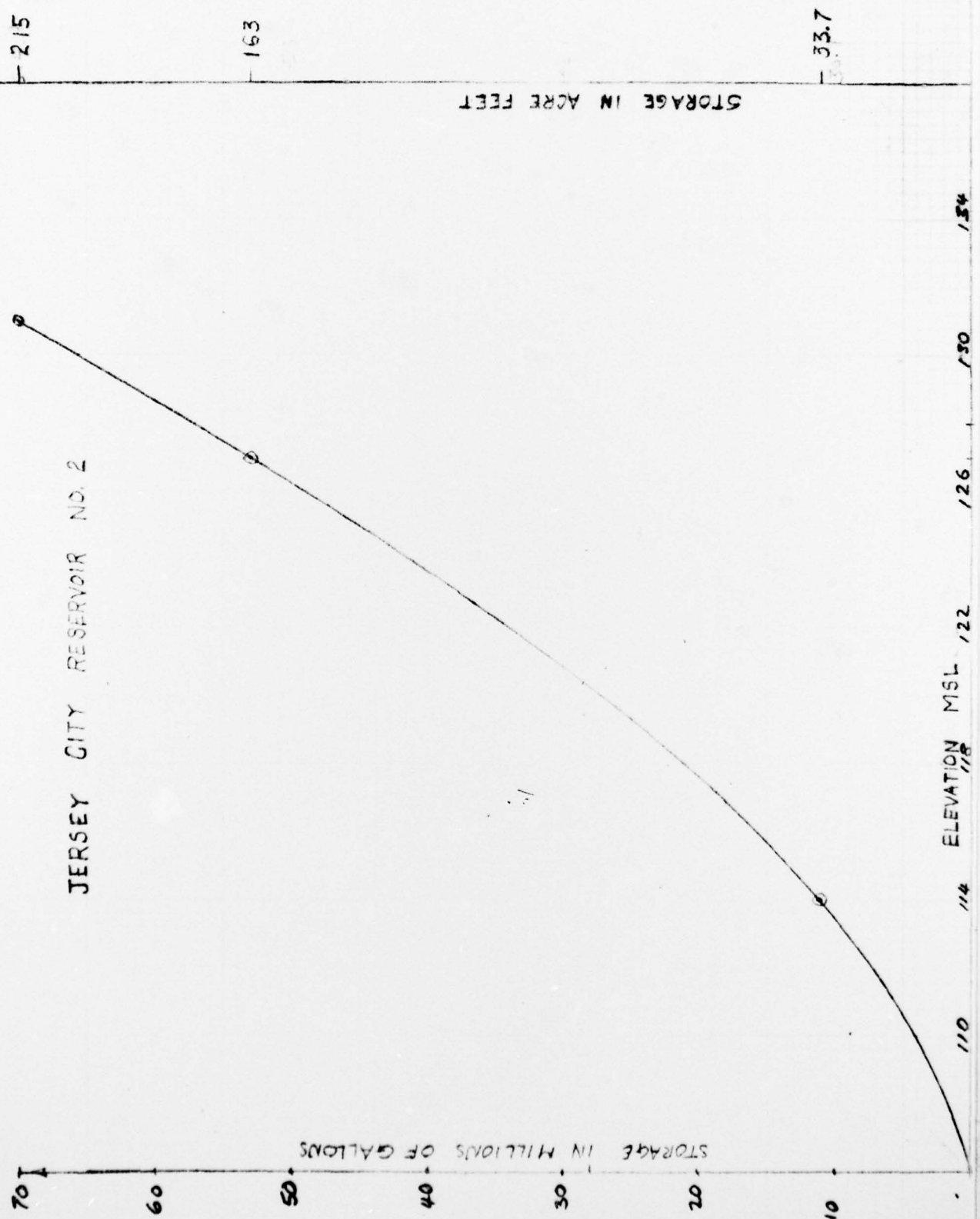
$$\therefore \text{PMP} = \left(\frac{13.3 \times 26}{12} \right) = 28.8 \text{ Acre Feet}$$

Storage at EL. 131 = 210 Acre Feet

Storage at EL. 127 = 163 Acre Feet

Available freeboard storage = 52 Acre Feet

SHEET A-3



BY D.J.M. DATE 2-78
CHKD. BY _____ DATE _____
SUBJECT _____

LOUIS BERGER & ASSOCIATES, INC.
JERSEY CITY WASTEWATER
DRAWDOWN

SHEET NO. A-4 OF _____
PROJECT C222

Drawdown calculation

Storage between El. 131.0 & El. 114.0

from curve

$$= (70,000,000 - 11,000,000)$$

$$= 59,000,000 \text{ gallons}$$

$$= 7,887,700 \text{ cubic feet}$$

Rate of discharge = 10.0 cfs

$$\text{time} = \frac{7,887,700}{10 \times 3600 \times 24} = 9.12 \text{ days; say 9 days}$$

between El. 127 & El. 114

$$\text{Storage} = (53 \times 10^6 - 11 \times 10^6)$$

$$= 42 \times 10^6 \text{ gallons}$$

$$= 5,614,973 \text{ cubic feet}$$

$$\begin{aligned} \text{Rate of discharge} &= 10.0 \text{ cfs} \\ \text{time} &= \frac{5,614,973}{10 \times 3600 \times 24} = 6.5 \text{ days; say 7 days} \end{aligned}$$

| REPORT DOCUMENTATION PAGE | | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|--|-----------------------|--|
| 1. REPORT NUMBER NJ00523 | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle) Phase I Inspection Report National Dam Safety Program Jersey City Reservoir No. 2 Dam Hudson County, N.J. | | 5. TYPE OF REPORT & PERIOD COVERED FINAL |
| 7. AUTHOR(s) F. Keith Jolls, P.E. | | 6. PERFORMING ORG. REPORT NUMBER |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS Louis Berger & Associates Inc. 100 Halsted Street East Orange, N.J. | | 8. CONTRACT OR GRANT NUMBER(s) DACW61-78-C-0124 |
| 11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, Philadelphia Custom House, 2d & Chestnut Streets Philadelphia, Pennsylvania 19106 | | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS |
| 14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) | | 12. REPORT DATE August, 1978 |
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| 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) | | |
| 18. SUPPLEMENTARY NOTES Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151. | | |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dams--N.J. Jersey City Reservoir No. 2 Dam, N.J. National Dam Safety Program Phase I Dam Safety Dam Inspection | | |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report. | | |